

REMARKS

Applicants have amended their claims in order to further define various aspects of the present invention. Specifically, Applicants have amended claim 1 to recite that m is 2 and n is 1, such that in compound (c) there is one “OH” group on each benzene ring and two “CH₂ OR” groups on each benzene ring. Applicants have further amended claim 1 to recite that each of the Rs represents independently hydrogen, a methyl group or an ethyl group. Applicants have also corrected typographical errors in claim 6.

The concurrently filed RCE Transmittal is noted. In view of the filing thereof, entry of the present amendments is clearly proper, notwithstanding the Finality of the Office Action mailed April 7, 2010. In addition, it is respectfully submitted that the present amendments constitute the necessary Submission supporting the RCE transmittal.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed April 7, 2010, that is, the teachings of U.S. Application Publication No. 2003/0204117 to Matsuishi, et al., Japanese Patent Document No. 2000-305268 (Tadayuki ‘268), and Japanese Patent Document No. 2001-312063 (Tadayuki ‘063), under the provisions of 35 U.S.C. § 102 and 35 U.S.C. § 103.

Initially, as will be discussed infra, it is respectfully submitted that Tadayuki ‘268 would not have taught the presently claimed subject matter, in light of the requirements of 35 USC 102.

Moreover, the teachings of the applied references would not have disclosed or suggested the presently claimed subject matter, including compound (c) of the

photosensitive polymer composition; and even assuming, arguendo, that the teachings of references as applied by the Examiner in paragraphs 4 and 5 on pages 4-11 of the Office Action mailed April 7, 2010, would have established a prima facie case of obviousness, the evidence presently of record overcomes any such prima facie case of obviousness, and supports a conclusion of unobviousness of the presently claimed invention.

Thus, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a photosensitive polymer composition as in the present claims, including, in addition to the recited polyamide and the compound which generates an acid upon receiving light, the compound represented by the general formula (II) in claim 1, including wherein each of R¹ and R² independently represents a fluoroalkyl group having 1-3 carbon atoms, with one "OH" group (n=1) on each aromatic ring and with two "CH₂OR" groups (m=2) also on each aromatic ring. See claim 1.

As discussed in detail infra, it is respectfully submitted that Tadayuki '268, while generically disclosing many substituents on the benzene rings, does not anticipate the substituents of the present claims within the meaning of 35 USC 102; and in view of the unexpectedly better results achieved according to the present invention, as seen by the evidence of record, including Example 1 and Comparative Example 4 of Applicant's disclosure, discussed infra, unobviousness has been established.

It is emphasized that the present claims recite that the compound (c), represented by the general formula (II), has, inter alia, the following specific features:

- (i) compound (c) has four CH₂OR groups (m=2) and two OH groups (n=1) per molecule; and

(ii) compound (c) has fluoroalkyl groups as R¹ and R².

It is respectfully submitted that none of the cited references describe a compound, corresponding to compound (c) of the present claims, having the specific combination of features (i) and (ii) as in the present claims, and, thus, the claimed composition has novelty, even in light of the teachings of Tadayuki '268.

Particularly, in the examples of Tadayuki '268, in Example thereof, the compound corresponding to the compound (c) in the present invention, has two CH₂OR groups, and the compounds in Examples 2 and 3 have no CH₂OR groups. In the Examples of Tadayuki '268, only the compound in Example 2 has fluoroalkyl groups, and such compound has no CH₂OR groups. Thus, and as will be discussed in more detail infra, while Tadayuki '268 discloses a variety of compounds in paragraph [0044], none of those compounds have the specific combination of features (i) and (ii) as in the present claims.

As discussed in more detail infra, and as seen by the evidence in Applicants' specification, particularly a comparison between Example 1 and Comparative Example 4, the composition of the present claims, having compound (c) with both of the features (i) and (ii), achieves effects of high sensitivity, good shape of the pattern and high resolution. If the compound (c) lacks either one of the features (i) and (ii), the composition cannot achieve such effects. For example, in comparing Example 1 with Comparative Example 4, wherein in Comparative Example 4 R¹ and R² of the compound corresponding to Compound (c) in the present claims are not fluoroalkyl groups but alkyl groups, a low sensitivity and poor pattern formation occur.

When m=1 in the Formula (II), the resulting composition has low sensitivity and poor pattern formation.

Thus, it is respectfully submitted that the teachings of the applied references, particularly of Tadayuki '268, describing many different materials for the compound corresponding to component (c) of the present claims, would not have led one of ordinary skill in the art to the specific photosensitive polymer composition of the present claims, including the compound represented by the general formula (II) with substituents as in the present claims; and, in any event, the teachings of the applied references would have neither disclosed nor would have suggested unexpectedly better results achieved by the presently claimed composition, including the component (c), particularly with respect to sensitivity of the composition, as discussed infra.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a method of producing a pattern, including applying the photosensitive polymer composition according to claim 1 on a support substrate, with subsequent light exposure, development and heat treatment (see claim 8); or the electronic part including an electronic device having a layer of a pattern obtained by the method according to claim 8 (see claim 10).

In addition, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such a photosensitive polymer composition as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, amounts of components in the composition as in claims 4, 12 and 13.

Moreover, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such method of producing a pattern as in the present claims, having features as discussed

previously in connection with claim 8, and, additionally, wherein the exposure light source used in the step of exposure generates i-line (see claim 9); and/or wherein the developing is performed utilizing an alkaline aqueous solution (see claim 14); and/or wherein the heat treating is performed at a temperature in a range of 150°-450°C (see claim 15).

In addition, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such photosensitive polymer composition as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, wherein the composition further includes a compound (component (d)) which reduces solubility of the component (a) with respect to an alkali aqueous solution (note claim 5); in particular, wherein this compound which reduces solubility of the component (a) is a diaryliodonium salt represented by the general formula (III) in claim 6, or amounts of components (b)-(d) set forth in claim 7.

Attention is again directed to Example 1 and Comparative Example 4, of Applicants' disclosure, set forth respectively from pages 25 and 31 of Applicants' substitute specification submitted with the Preliminary Amendment filed July 12, 2006 (hereinafter Applicants' substitute specification). Example 1 and Comparative Example 4 differ in that Example 1 is a 1, 1, 1, 3, 3, 3-hexafluoropropane, while in Comparative Example 4 R¹ and R² are not fluoroalkyl groups but alkyl (propane) groups. Note that in each of Example 1 and Comparative Example 4, m is 2 and n is 1, consistent with the present claims. As seen on pages 25 and 26 of Applicants' specification, the proper exposure amount in Example 1 was 280 mJ/cm²; and after the obtained pattern was heated at 350°C under a nitrogen atmosphere for one hour, the pattern of a polybenzoxazole film having good shape was obtained, with no

deformation of the pattern owing to the cure. In contrast, in Comparative Example 4, the proper exposure amount was determined to be 320 mJ/cm², and thus sensitivity was not so high. As can be appreciated from Example 1 and Comparative Example 4, where R¹ and R² are outside the scope of the present claims, poorer results are achieved; that is, the presently claimed subject matter, including R¹ and R² for compound (c), achieves unexpectedly better results in sensitivity and pattern formation.

In the first full paragraph on page 16 of the Office Action mailed April 7, 2010, the Examiner proposes two compounds that the Examiner alleges to be taught by Tadayuki '063, which should be tested as the closest prior art. Note, however, that the compounds referred by the Examiner have a single CH₂OR group on each benzene ring (that is, m=1). It is respectfully submitted that Tadayuki '063 discloses two CH₂OR groups in total on the benzene rings, outside the scope of the present claims. It is respectfully submitted that the compounds referred to by the Examiner on page 16 of the Office Action mailed April 7, 2010, are not the closest compounds in light of the present claims, wherein m=2 and n=1.

Contrary to the contention by the Examiner, it is respectfully submitted that the compound having the most pertinent structure to that of a compound (c) in the present claims is Comparative Example 4 of Applicants' original disclosure. It is respectfully submitted that specific disclosures in Tadayuki '268 and Tadayuki '063 (that is, Examples 1-3 and paragraph [0044] of Tadayuki '268, and Examples 1-3 and paragraph [0040] of Tadayuki '063) have greater differences with respect to compound (c) of the present claims, than the differences between compound (c) of the present claims and the corresponding compound of Comparative Example 4 of the above-identified application, and thus are less pertinent. It is respectfully

submitted that the comparison between Example 1 and Comparative Example 4 of the specification of the above-identified application provides the fairest comparison, and establishes unexpectedly better results achieved according to the present invention, wherein the composition includes fluoroalkyl groups as in the present claims.

In this regard, it is emphasized that Tadayuki '063 and Tadayuki '268 describe no preference in connection with including fluoroalkyl groups, and that in the Examples of these references only the corresponding compound in Example 2 of Tadayuki '268 has fluoralkyl groups, and this compound in Example 2 has no CH₂OR groups. It is respectfully submitted that the results achieved according to the present invention are unexpectedly better as compared to the teachings of the closest prior art.

The present invention relates to a photosensitive polymer composition, a method of producing a pattern using such composition, and electronic parts formed by such method using this composition. In the electronic part, the pattern formed of the composition remains as a component of the electronic part. The composition becomes a polybenzoxazole heat resistant polymer by heat treatment, and can be used, to be illustrative and not to be limiting, as a surface protection film and/or an interlayer insulating film in electronic parts such as semiconductor devices.

Conventionally, polyimide has been widely used as a surface protection or interlayer insulating film, due to advantages in resistance to heat, and advantages in mechanical properties and electrical properties, as well as easy film formability and ability to be planarized. Photosensitive polyimide compositions have use, e.g., in order to avoid the need of a photoresist. In addition, as described in

paragraph [0007] on pages 2 and 3 of Applicants' substitute specification, positive type photosensitive polyimides have been proposed.

However, such previously proposed polyimide compositions have low sensitivity, because they are sensitive to wavelengths mainly of 300nm or less. In particular, it is difficult to use such compositions with i-line steppers, which have a single wavelength of light at 365nm, recently used in, e.g., manufacture of electronic parts.

While it has been proposed to add a phenol binuclear compound for enhancing sensitivity of compositions including a polyimide precursor, when the phenol binuclear compound is added the pattern is easily deformed by melting of the phenol compound in a thermal cure process after development, resulting in a problem such as degradation of resolution. Thus, it has been difficult to provide a photosensitive polymer composition having sufficient sensitivity, yet which does not cause pattern deformation in the thermal cure process after development.

Against this background, Applicants provide a photosensitive polymer composition having both high sensitivity and which gives a pattern that retains its form in a step of thermal curing; that is, which provides a pattern having a high resolution and good shape, yet wherein the composition has high sensitivity. Applicants have found that by incorporating the component (c) in the composition which includes the recited polyamide component (a) and the compound (b) which generates an acid upon receiving light, the component (c) increases a dissolving speed of the exposed portion to enhance the sensitivity when developed in the alkali aqueous developing solution. Note paragraph [0042] on page 14 of Applicants' substitute specification. See also paragraphs [0014]-[0016] on page 7 of Applicants' substitute specification.

Tadayuki '268 discloses a photosensitive polymer composition of a positive type being formed of various combinations of materials, as set forth in paragraphs [0008]-[0014] thereof. Note also paragraph [0042] of this patent document, disclosing that in general formula (II), as a divalent basis shown by X, a carbon number of a methylene group, ethylene group, propylene group, etc., is used. This patent document also discloses that some or all of the hydrogen atoms of the hydrocarbon groups can be replaced with halogen atoms, such as a fluorine atom, in connection with Formula 18.

It is respectfully submitted that Tadayuki '268 does not disclose, that is, would not have guided one of ordinary skill in the art to, the composition as in the present claims, including the compound (c) wherein m=2 and n=1, each of the Rs represents hydrogen, a methyl group or an ethyl group, and each of R¹ and R² independently represents a fluoroalkyl group having 1-3 carbon atoms.

The contention by the Examiner on page 12 of the Office Action mailed April 7, 2010, that the "Examiner" clearly envisages [Tadayuki '268] at least disclosing a 1,1,1,3,3,3-hexafluoropropyl group", is noted. It is respectfully submitted that the issue is not what the Examiner sees, but rather what one of ordinary skill in the art would understand that the reference (Tadayuki '268) teaches. In view of the many compounds for the ingredient (c) as in Tadayuki '268, including those within each of Formulas II-IV, it is respectfully submitted that Tadayuki '268 does not sufficiently guide one of ordinary skill in the art to a composition with components (a) and (b) and with the component (c) as in the present claims, including m, n R¹ and R², so as to constitute an anticipation of the presently claimed subject matter.

In connection with the obviousness rejection over the teachings of Tadayuki '268, in Item 4 on pages 4-7 of the Office Action mailed April 7, 2010, it is

respectfully submitted that any prima facie case of obviousness over the teachings of this reference is overcome by the evidence of record, discussed previously.

Tadayuki '063 discloses a positive-type, heat-resistant photosensitive polymer composition that, when thermally treated, becomes a polybenzoxazole-type heat-resistant polymer that is suitable as the passivation films, interlayer insulating films and so forth, of electronic components. The composition includes (i) a specific polyamide having a repeating unit expressed by General Formula I on page 8 of the English translation of this patent document, (ii) a compound that generates an acid when exposed to light, and (iii) a compound having alkoxyethyl groups and phenolic hydroxyl groups in the molecule. Note General Formula II on page 9 of the English translation of Tadayuki '063, wherein X represents a single bond or divalent organic group; Rs individually represent an alkyl group or alkynyl group; R¹ and R² individually represent an alkyl group or alkynyl group; m and n are individually one or two; and p and q are individually an integer of from 0-3. Note the further disclosure in this patent document that X is a group expressed by the Chemical Formula 7 in paragraph [0010] of this patent document, wherein the two "A's" individually represent a hydrogen atom or an alkyl group having 1-10 carbon atoms. Note that substitution with halogen atoms is discussed in connection with Formula 10 of Tadayuki '063, not Formula 11 thereof.

It is respectfully submitted that this patent document does not disclose, nor would have suggested, such composition as in the present claims, including the component (c) wherein, inter alia, m=2, n=1, each of the R's is independently hydrogen, methyl or ethyl , and each of R¹ and R² independently represents a fluoroalkyl group having 1-3 carbon atoms.

It is respectfully submitted that the additional teachings of Matsuishi, et al. and of Tadayuki '268 would not have rectified the deficiencies of Tadayuki '063, such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Matsuishi, et al. discloses hydroxymethyl-substituted polyfunctional phenols, having the general structure (I) as in paragraph [0009] on page 1 of this patent document. Note that X of the general structure (I) can be a bivalent group (c) represented by the General Structure (IV) in paragraph [0017] on page 1 of this patent document, wherein R₇ and R₈ each independently represent a hydrogen atom or a monofluoromethyl, difluoromethyl or trifluoromethyl group, but R₇ and R₈ cannot both be hydrogen atoms. See also paragraphs [0026] and [0027] on page 2 of this patent document. This patent document discloses that the compounds can be used as a photo-resist material or to derive polyphenol compounds through further reaction with phenolic compounds, or as a compounding agent that adds to the molecular weight of novolac phenol resins or as hardening agents for epoxy resins of specified uses. See paragraph [0044] on page 4 of this patent document.

Tadayuki '268 has been previously discussed.

Even assuming, arguendo that the teachings of Tadayuki '063, Matsuishi, et al., and Tadayuki '268 were properly combinable, such combined teachings would neither disclosed nor would have suggested the specific combination of features of compound (c) as part of the photosensitive polymer composition of the present claims, in particular, wherein m is 2 and n is 1, and each of R¹ and R² independently represents a fluoroalkyl group having 1-3 carbon atoms, and unexpectedly better results achieved thereby.

Taking the teachings of the Tadayuki references and Matsuishi, et al., it is respectfully submitted that the present invention provides a selection of specific substituents for the compound (c), including number of OH groups and number of CH₂OR groups, and R¹ and R², providing unexpectedly better results. It is respectfully submitted that such selection, achieving unexpectedly better results, provides a basis for patentability of the presently claimed invention.

In view of the foregoing comments and amendments, and in view of the concurrently filed RCE Transmittal, entry of the present amendments, and reconsideration and allowance of all claims pending in the above-identified application, are respectfully requested.

Applicants request any shortage in fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case 1270.46327X00), and credit any excess payment of fees to such Deposit Account.

Respectfully submitted,

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